# MASTER'S IN FINANCE

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DISSERTATION

# POST-EARNINGS-ANNOUNCEMENT DRIFT: EVIDENCE FROM THE EURO AREA DURING AND AFTER THE FINANCIAL CRISIS

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***Abstract***

The aim of this dissertation is to investigate the persistence of the Post-Earnings-Announcement Drift (PEAD) over the crisis and post-crisis years. Using the period from 2008 to 2017 as a sample, I will analyze the impact produced on the PEAD by the financial instability due to Financial Crisis and consequential Debt Crisis in the Eurozone.

Based on the results of statistical regressions, I conclude that the phenomenon continues to exist. However, there are some discrepancies in magnitude variation whether you consider the Global Financial Crisis (late 2008) or the Eurozone Financial Crisis (late 2009) as the starting date for the recession. My results indicate that the crisis period from late 2009 onwards provides much higher returns which are less explained by any of the risk factors compared to the crisis period starting on October 2008.

Additionally, excluding negative EPS implies attenuation of PEAD regardless of the inception of the sample.

Keywords: PEAD, EPS, SUE, Crisis, Earnings Announcement

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# List of abbreviations

AT – Algorithmic Trading

BHAR – Buy-and-Hold Return

BTMV – Book to Market Value

DID – difference-in-differences

EPS – Earnings Per Share

ES – Earnings Surprise

IFRS – International Financial Reporting Standard

MBTV – Market to Book Value

PEAD – Post-Earnings-Announcement Drift

SUE – Standardized Unexpected Earnings

# Contents

# 1. Introduction

The concept that prices fully reflect all available information, known as the Efficient Market Theory (Fama, 1970) has been and continues to be subject to a variety of challenges in financial markets. According to Thaler (1999), five areas which contradict main financial theories can be identified. Among them are volume, volatility, cash dividends, the equity premium puzzle and predictability. In this study, I will focus exclusively on the last anomaly since it includes one of the most enduring trading strategies, the Post-Earnings-Announcement Drift (PEAD).

The PEAD was first discovered by Ball and Brown (1968) and later confirmed by Foster, Olsen, & Shevlin, (1984), Bernard & Thomson (1989) and others. The strategy states a positive relation between earnings surprise and subsequent abnormal returns. The larger part of profits is concentrated on a holding period of about 3 months. However, there is also evidence for longer holding periods, *i.e.* for a holding period of 6 months (Bernard & Thomas, 1989).

Francis (2007) concluded that a great part of abnormal returns is derived from securities with high informational uncertainty. He also shows that this is one of the predominant characteristics of securities concentrated in the extreme portfolios ranked by the standardized unexpected earnings (SUE). This brings into question the performance of trading strategies in general and in particular of the PEAD in an environment of financial stress. Hokkio and Keton (2009) characterize financial crisis periods as times of increased uncertainty regarding the fundamental value of assets, as well as the behavior of other investors and informational asymmetries. The combination of these factors impacts the volatility of financial assets.

The main goal of my investigation is to analyze a strategy based on the standardized unexpected earnings (SUE), and how it is affected by unstable financial and economic environments. This study extends an already wide range of literature which examined the PEAD over different time frames and a variety of financial markets (*i.e.* PEAD in the UK by Liu, Strong, & Xu, 2003; Spain by Forner., Sanabria, & Marhuenda*, 2009*; Greece by Forbes, & Giannopoulos, 2015; international by Griffin, Kelly, & Nardari, 2006 and by Hung, Li, & Wang, 2014).

My investigation contributes in four major ways. Firstly, it provides a recent analysis over the period from 2008 to 2017 of a selection of Eurozone financial markets. The choice to focus the analysis on Eurozone markets was motivated by a lack of empirical studies on the PEAD for these countries for the post global financial crisis period. The second contribution of my study is to select a period of crisis and provide a deeper understanding of its effects on one of the most persistent financial market anomalies, as the inception of the crisis can be defined as starting either in September 2008 (the beginning of the global financial crisis) or in October 2009. The later date was obtained from Ahmad, Sehgal, & Bhanumurthy, (2013) investigation on the Eurozone crisis and BRIICKS stock markets. The third contribution is that I study the impact of the global financial crisis by analyzing the data in two different time frames, as I recognize two possible inception dates for the crisis. As a final contribution, I conduct a robustness test which consists of eliminating both negative and approximately zero expected EPS. This is justified by the belief that analysts tend to be overoptimistic in negative forecasts, which is mainly attributable to reluctance (Butler & Saraoglu., 1999).

Within the scope of my analysis, the PEAD strategy is statistically significant up until a very recent period (March 2017). Considering the full sample period, the results indicate that the shorter the holding period, the higher the annualized returns. For a holding period of 12 months it is possible to observe a 6.71% annualized return, and 10.22% for a period of 3 months, which is a significant increase. The regressions that these results stem from do not account for risk factors. However, when those are added, the difference between them increases, with the new results being 7.34% versus 10.86% for 12 months and 3 months respectively. There is also a significant discrepancy in results when I test the PEAD on both inception dates, late 2008 and late 2009. In the latter, the results exhibit a behavior more consistent with the PEAD strategy. Long and Short positions are therefore significantly more positive and negative, respectively, regardless of the holding period.

The remainder of this work is organized as follows: in Section 2, I present a literature review regarding the PEAD where I also develop a research question. In section 3, I present the data used along the investigation. Then, in section 4, I explain the methodology which my investigation has followed. Section 5 is subdivided into four sections, where the analysis goes from a general perspective to a more detailed one. Finally, section 6 summarizes and describes the main conclusions I have obtained from this investigation. I also make suggestions on possible improvements and further developments. All the references used on my investigation can be found in section 7.

## 2. Literature Review and Hypothesis Development

A positive relationship between Earnings Surprises (ES) in the announcement day, and the further developments in stock prices (resulting in abnormal returns) known as the Post-Earnings-Announcement Drift (PEAD) is one of the most enduring anomalies in capital markets.

This phenomenon, first documented about fifty years ago (Ball & Brown,1968; Foster (*et al.*, 1984)), is the subject of a very extensive body of literature. Bernard and Thomas (1989) proposed, as a way to measure the PEAD, the implementation of a long-short SUE (standardized unexpected earnings) investment strategy. It consisted in going long on the stock of firms with "good"/positive surprise (fitted in the highest decile) and shorting the firm's stocks that had "bad"/negative surprise (fitted in the lowest decile). More specifically, the PEAD is generally defined in the literature above as the persistence of this difference between the top and bottom SUE deciles over 60 trading days after the quarter's returns announcement.

To this day, no consensus was found as to the factors that fully explain the PEAD phenomenon (Setterberg, 2011). The predominant belief is that investors underreact to the information contained in earnings announcements (Bernard and Thomas, 1989/1990). This challenges the semi-strong form of the Efficient Market Hypothesis (Fama, 1970), which states that new *obviously publicly available information* is quickly and fully absorbed by stock prices, and that there is almost no possibility for investors to earn abnormal returns.

This consequentially led to numerous explanations and replication attempts over the years. In recent work, Zhang (2017) identifies three categories in which most explanations for the PEAD's persistence and existence can be grouped.

The first group is **Behavioral,** where investors are assumed to have full information but are irrational in their behavior. It considers factors related to investor's irrationality being subjected to conservative (under-reaction) and representative (overreaction) biases (Barberis, Shleifer & Vishny, 1998). Another source of investors' bias can come from their overconfidence and its respective changes due to self-attribution making them overreact to private information (attributing it too much weight) and under-react to public information (too little weight) (Daniel, Hirshleifer & Subrahmanyam, 1998).

The second group considers **Structural Uncertainty** where investors are assumed to not have full information but to act rationally. It is mostly related to the informativeness of earnings announcements' content, due to their opaqueness and their date availability that lead to increased uncertainty and consequentially to a greater PEAD. A higher opaqueness therefore implies a higher PEAD, especially when the Book-to-Market ratio is higher (Yan and Zhao, 2011), and institutional holdings and analyst coverage are lower (Brown and Han, 2000). Opacity also may lead to divergence in investors' opinions (Garfinkel and Sokobin, 2006) and disagreements among analysts (Kim and Kim, 2003).

Lastly, **Limits of arbitrage constraints** (market frictions) are also considered, which refer to transaction costs (Ng, Rusticus & Verdi, 2008; Chordia, Goyal, Sadka, G., Sadka, R. & Shivakumar, 2009) and arbitrage risks. The former refers to costs such as the bid-ask spread and short-sale costs and commissions which, according to Chordia (*et al*. 2009), are responsible for most of the profit PEAD's strategy may provide. The latter one is defined as the unsystematic part of stocks' volatility by Shleifer and Vishny (1997), Wurgler and Zhuravskaya (2002), and Mendenhall (2004). It consequently constrains investors in fully exploiting arbitrage opportunities, more precisely by being bound by the respective magnitude the conjunction of these factors creates.

These categories of factors that explain the PEAD can then be arranged according to the following logic: an initial under-reaction, due to behavioral and structural explanations, creates a mispricing which is not afterwards fully corrected.

Despite still being relevant, throughout the last decades, the PEAD lost some of its significance, mainly due to exogenous factors that impacted the structure of the financial markets over time. Some of these factors are the appearance of Algorithmic Trading (AT) in the mid-1990s (associated with improved price efficiency, lower bid-ask spreads and sophisticated trading among others), the obligation of European countries to adopt International Financial Reporting Standards (IFRS) from 2005 onwards (*i.e*. increasing the quality of the information contained in reports, as well as making it more transparent and comparable), and the economic and financial crisis.

As Zhang (2017) has shown, the PEAD has been attenuated (especially for firms characterized by high investor sophistication, low structural uncertainty, low arbitrage risk and low transaction costs). However, it still exists, being statistically significant at the 1.90% level, over a period of 60 trading days after earnings announcements, even after controlling for a large set of explanatory variables. Zhang has also studied the relationship between Algorithmic Trading and the PEAD, having concluded that there is no direct statistical relation between an increase in the former and an attenuation in the latter. This conclusion was achieved after controlling for the effect of decimalization and an increase in earnings quality using matched-sampling test procedures. However, indirect effects can be found, as AT implies a more efficient incorporation of trading signals into prices of stocks due to improved price discovery, but not through the improvement in liquidity around the earnings announcement period.

Regarding the so-called information shock due to the mandatory implementation of IFRS, Hung (et *al.*, 2014) showed, by using a difference-in-differences (DID) approach, that there was a decrease in the PEAD for the treatment firms (*i.e.* affected by the IFRS adoption in 2005). The PEAD decreased when the financial reporting changes were greater, and when liquidity, analysts' forecast accuracy, and institutional ownership increased. This highlights the greater impact in firms with lower distraction effects, more sophisticated investors, lower limits-to-arbitrage, and in countries with a stricter rule of law.

Some literature has also indirectly covered the period of the financial crisis and observed a significant decrease in the PEAD, especially in 2008, when a major financial shock occurred. The shock provoked significant changes in individual investors' perceptions that consequently influenced their own trading and risk-taking behaviors (Hoffmann, Post & Pennings 2011). This period is characterized by highly uncertain and extremely volatile market conditions, and is thus of increased interest for a PEAD analysis, as greater information uncertainty provokes even higher investor under-reaction (Zhang, 2006), and is also responsible for determining a great part of the PEAD's magnitude (Gerard, 2012).

In this regard, it fits perfectly not only into the first group of explanations but also into the second one, as both the investors' behavior and the reliability of the information provided was undermined during financial and later economic crisis (Demirguc-Kunt, Martinez-Peria & Tressel, 2015). It is logical to assume that the shock associated with financial stress should provide an opposite reaction to the exogenous factors mentioned above. Therefore, a greater PEAD should be expected during the Crisis Period, when compared with non-crisis periods. All of the above leads to the following research questions:

Does the PEAD remain economically significant considering the Eurozone's financial market as a whole?

If so, is the impact of the crisis expected to influence its magnitude?

# 3. Sample and Data

The magnitude of the PEAD is affected by numerous characteristics, including the firm's size, with which the PEAD is inversely correlated (Bernard & Thomas, 1989). Since my aim is to construct a fully representative sample of the Eurozone, and in order to have a sample as realistic as possible, I decided to use companies listed on the main stock market indexes of each country's Stock Exchange. However, I only included countries which became part of Eurozone before 2006. This choice is justified by several factors. The first, is the need to account for a one year implementation lag related to the IFRS. Then, I split the period in order to obtain crisis and post-crisis subperiods. Thus, the indexes used were: WBI - Wiener Börse Index for **Austria (AT)**, Bel All-Shares for **Belgium (BE)**, OMX for **Finland (FI)**, The CAC All-Tradable index for **France (FR)**, CDAX for **Germany (DE)**, Athex All Shares for **Greece (GR)**, AEX All Shares for **Netherland (NL)**, PSI All Shares for **Portugal (PT)**, ISEQ Overall Index for **Ireland (IE)** and Madrid Se General for **Spain (ES)**. The only country missing is **Italy (IT)** for which a list of FTSE MIB and/or FTSE Italia All Shares constituents was not available on Datastream. Table 1 provides an overview of an average country contribution in each quarterly sample.

**Table 1.** Average number of companies by country per quarterly sample

| AT | BE | DE | ES | FI | FR | GR | IE | NL | PT |
|---|---|---|---|---|---|---|---|---|---|
| 55 | 44 | 470 | 87 | 114 | 187 | 163 | 39 | 88 | 41 |

My analysis covers the period from October 1st, 2008 to the March 31st, 2017. There are two main reasons to start the sample in 2008. First, it was in September of 2008 that the Lehman Brothers default occurred leading to a tremendous mark on global financial markets. This parallels the Eurozone market by the difference in volatility of sovereign CDS spreads before and after this specific date (Gündüz & Kaya, 2014). Secondly, choosing this time frame allows me to analyze and compare two four year periods during and after the global financial and economic crisis throughout the Eurozone.

Companies from financial services were excluded, in line with common practice from previous quantitative investigation, and due to the different interpretation that their higher than normal leverage levels could bring (Fama and French, 1992)[1]. The way I filter companies out from financial services is by using an ICBIN code which identifies the industry to which a company belongs. This roughly corresponds to a cut of 263 companies from financial sectors, making each quarterly sample contain about 1313 companies before checking the data availability.

In each quarterly sample I only include companies which have reported their Earnings Announcements during the calendar earnings announcements period[2].

[1] Higher leverage for non-financial firms usually serves as indication of distress, where the same interpretation doesn't necessarily apply to financial firms due to its normality.

[2] Q1 (01-01 to 31-03); Q2 (01-04 to 30-06); Q3 (01-07 to 30-09); Q4 (01-10 to 31-12).

This choice is justified by the need to overcome look-ahead bias while formulating portfolios, so that it is possible to replicate them on real markets.

It is important to highlight that in order for a company to be included in my quarterly sample it should have data available for each of 3 main variables (Actual EPS report date, EPS Actual, EPS Estimated); otherwise it would be excluded as it won't be possible to calculate the SUE. On each quarterly sample a cut of 2% on both top and bottom of the SUE was applied, which corresponds to an average cut of 14 companies so as to exclude outliers.

**Table 2.** Average number of companies by industry[3] per quarterly sample

| BM | CG | CS | F | HC | I | OG | TN | TC | U |
|---|---|---|---|---|---|---|---|---|---|
| 111 | 229 | 198 | 263 | 106 | 362 | 46 | 204 | 19 | 38 |

All the requirements mentioned above lead to a drastic decrease in the quarterly sample. On average, each portfolio separately has about 30 companies from an average of 308 companies per quarterly sample. Table 2 presents descriptive statistics regarding the two fundamental variables used in my investigation. And in Table 3 I present descriptive statistics regarding a variable criteria on which the whole investigation is based on, the SUE.

**Table 3.** Descriptive Statistics of the two fundamental variables (Analysts' Mean EPS Estimates and Reported EPS). Q1 2008 – Q4 2016

| Group of Variables | Variables | # of Obs. | Mean | Median | Std Dev | Kurtosis | Skewness |
|---|---|---|---|---|---|---|---|
| Estimates | 1st D. | 1060 | 0,31 | 0,06 | 2,20 | 127,54 | 8,30 |
| | 10th D. | 1060 | 0,25 | 0,11 | 1,37 | 203,40 | 7,27 |
| | Full S. | 10617 | 0,43 | 0,22 | 1,78 | 521,90 | 18,87 |
| Actuals | 1st D. | 1060 | -0,09 | -0,03 | 1,76 | 166,11 | 0,44 |
| | 10th D. | 1060 | 0,50 | 0,22 | 1,54 | 136,97 | 7,59 |
| | Full S. | 10617 | 0,40 | 0,21 | 1,70 | 549,33 | 18,00 |

[3] BM - Basic Materials, CG - Consumer Goods, CS - Consumer Services, F - Financials, HC - Health Care, I - Industrials, OG - Oil & Gas, TN - Technology, TC - Telecommunications, U - Utilities

**Table 4.** Descriptive Statistics of SUE. Q1 2008 – Q4 2016

| Group of Variables | Variables | # of Obs. | Mean (%) | Median (%) | Std Dev (%) | Kurtosis | Skewness |
|---|---|---|---|---|---|---|---|
| SUE | 1st D. | 1060 | -2,779 | -1,973 | 2,546 | 16,954 | -3,447 |
| | 10th D. | 1060 | 1,564 | 1,331 | 0,929 | 7,931 | 2,291 |
| | Full S. | 10617 | -0,163 | 0,000 | 1,389 | 45,132 | -4,307 |

The data for each firm and the Euro Area capital market as a whole, aggregates[4] I/B/E/S Earnings Per Share (EPS) Estimates and Actually Reported, the quarterly earnings announcements dates from 01/01/2008 to 31/12/2016 and adjusted prices for each company 20 days prior to the EPS report date. The data source for I/B/E/S was the Thomson Reuters Datastream.

For the purpose of measuring performance, I use monthly net returns for each firm in a sample – using monthly variations of a Datastream Datatype called Index Return. I use the 3M German Bond Bid Yield[5] as a proxy for risk-free rate in the European market.

To construct the three factors from the Fama-French model, I use the Market Values of each company at the end of the previous year (t-1) and MTBV (Market-to-Book Values) for each company at the end of the previous year (t-1), using Datastream in both cases.

# 4. Methodology

In this section I describe the overall procedure from decile ranking measures of ES to the formulation of portfolios.

## 4.1. *Test structure*

The methodology used in my investigation closely follows the test design presented in Setterberg's study (2011), which is consistent with Bernard and Thomas (1989). It consists of implementing an investment/trading strategy based on quarterly earnings announcements, or, more precisely, on the Earnings

[4]Data for the first three bullets were obtained from Thomson Reuters Eikon. The rest of them were obtained from Datastream.

[5] Later the rate of 3M German Bond Bid Yield was rearranged into a monthly rate using the following expression: $1M = (1 + 3M)^{1/3} - 1$.

Surprises (ES)[6], as previously mentioned in the Literature Review section. The Earnings Surprise represents the unknown market earnings which, in turn, is reflected in the respective stock prices. ES is measured as the difference between Actual EPS and Analyst Estimated EPS Consensus, which will be explained in more detail in the variable description section ahead.

The procedure is organized as follows: at the end of each calendar-quarter, the firms' reported EA during the previous 3 months were grouped into a sample quarter. Firms included in that sample were ranked according to their unexpected earnings scaled by the respective stock prices 20 trading days prior to the report date. I control for outliers by cutting 2% of the firms in the lowest and the highest SUE (4% from the total sample). This led to an average loss of 14 companies per quarter sample.

Based on those scaled rankings, firms are allocated into one of two portfolios. The first portfolio includes firms fitted in the lowest decile of SUE on which we take a short position, as it represents "bad news". The second portfolio is comprised of firms included in the highest decile on which we take a long position, as it represents "good news".

A third portfolio is constructed based on the difference between the first and second portfolios, which corresponds to the long-short hedge portfolio – arbitrage-based results of PEAD.

Then, returns for each of the portfolios are measured from the first day of the subsequent calendar-quarter for 60 trading days afterwards (approximately 3 months) as it is during this time range that 80% of Abnormal Returns occur (Foster *et al.*, 1984). As I am also interested in a long-term performance comparison, I will measure the returns in a 12-month period as well.

## 4.2. *Variable Description*

In this section I describe all variables used during the process of measuring the PEAD.

[6] "Unexpected Earnings" and "Earnings Surprise" are used as equivalent terms in this work.

### 4.2.1. Measure of Earnings Surprise

According to previous literature on this topic, ES can be measured in two ways due to two different measures of the market's expectation component in the equation below. These are the time-series approach (e.g., Foster *et al*., 1984; Bernard and Thomas, 1989) and analysts' consensus (e.g., Liu *et al*., 2003; Livnat and Mendenhall, 2006). I decided to use the analysts' consensus approach as it provides the drift that is not only more significant (about 30%) but also consistently larger (Livnat and Mendenhall, 2006). Also, the magnitude of the eventual drift is of prime interest for this investigation as it allows for an easier assessment.

The SUE can be expressed by the following equation:

$$\boldsymbol{SUE_{i,q,y}} = \frac{\boldsymbol{Actual_{i,q,y} - MeanEstimate_{i,q,y}}}{\boldsymbol{Price_{i,q,y}}} \quad (1)$$

Where $\boldsymbol{SUE_{i,q,y}}$ represents Standardized Unexpected Earnings for a firm $\boldsymbol{i}$ in the specific quarter $\boldsymbol{q}$ (where $\boldsymbol{q} \in \{1,2,3,4\}$) and in a certain year $\boldsymbol{y}$ (where $\boldsymbol{y} \in \{2008, 2009, \ldots, 2016\}$). $\boldsymbol{Actual_{i,q,y}}$ is the reported Earnings Per Share. $\boldsymbol{MeanEstimate_{i,q,y}}$ is the analysts' mean estimate of EPS for each quarter earnings announcement at the report date. $\boldsymbol{Price_{i,q,y}}$ is the stock price of the respective firm $\boldsymbol{i}$ 20 days before the announcement. This gap captures the time frame where expectations for the announcement still aren't incorporated into prices (Francis *et al*., 2007). An additional reason to use prices 20 days prior is that it enables us to overcome inconsistencies in report dates. Concerns regarding accuracy and consistency of those dates are discussed in the study of reliability of I/B/E/S earnings announcement dates by Acker and Duck (2009).

### 4.2.2. Measures of Returns

In this investigation I decided to assume an investor perspective. Thus, for the purposes of return measurements I use the Buy-and-Hold Return (BHAR) measure as it more closely mimics investors' experience (Barber and Lyon, 1997).

To measure monthly stock performance, I use the Index Return Datastream datatype, which is equivalent to the Net Returns when computed in a monthly variation mode.

$$\boldsymbol{R_{i,t} = \frac{RI_t - RI_{t-1}}{RI_{t-1}}} \tag{2}$$

Where the return Index can be expressed as following:

$$\boldsymbol{RI_t = RI_{t-1} \times \frac{P_t}{P_{t-1}}} \tag{3}$$

However, instead of gathering $\boldsymbol{RI_t}$ and $\boldsymbol{P_t}$ for each company, I used the (PCH#(X(RI), 1M) formula directly on Datastream.

$$\boldsymbol{AR_{i,t} = R_{i,t} - Rm_t} \tag{4}$$

Where $\boldsymbol{AR_{i,t}}$ stands for an abnormal return in month $\boldsymbol{t}$ for a firm $\boldsymbol{i}$.'s stock $\boldsymbol{R_{i,t}}$ is a monthly return in month $\boldsymbol{t}$ for firm $\boldsymbol{i}$.'s stock. $\boldsymbol{Rm_t}$ represents the Eurozone Market return in month $\boldsymbol{t}$, which corresponds to a value-weighted monthly return of the all equities traded on the main Eurozone Exchanges.

$$\boldsymbol{BHAR_{i,T} = \prod_{i=1}^{T} \left(1 + AR_{i,T}\right) - 1} \tag{5}$$

Where $\boldsymbol{BHAR_{i,T}}$ represents the firm $\boldsymbol{i}$'s buy-and-hold return for the holding period of up to $\boldsymbol{T}$ months (where $\boldsymbol{T} \in \{1,2, \ldots,12\}$) and $\boldsymbol{AR_{i,t}}$ stands for an abnormal return in month $\boldsymbol{t}$ for firm $\boldsymbol{i}$'s stock.

$$\boldsymbol{BHAR_{T,f} = \frac{1}{N}\sum_{i=1}^{N} BHAR_{i,T,f} \quad \begin{cases} p_L, & portfolio\ of\ a\ Long\ position \\ p_S, & portfolio\ of\ a\ Short\ \ position \end{cases}} \tag{6}$$

Where $\boldsymbol{BHAR_T}$ represents an equally-weighted buy-and-hold return of portfolio $\boldsymbol{p}$ for a holding period of $\boldsymbol{T}$ months (where $\boldsymbol{T} \in \{1,2, \ldots,12\}$) with a formation date $\boldsymbol{f}$ (where $\boldsymbol{f} \in \{1,2, \ldots,34\}$). $f = 1$ corresponds to portfolios formed on the first day of the calendar quarter Q1 2008 where companies which reported during the whole Q4 2007 are included. The same logic extends to the rest of the 34 formation dates, where $f = 34$ corresponds to portfolios formed at the first day of the calendar Q4 2017. There are two types of portfolios: $\boldsymbol{p_S}$ = 1 (Short) and $\boldsymbol{p_L}$= 10 (Long). Number one and ten demonstrate the lowest and the highest deciles respectively. Intermediate deciles/portfolios were omitted as they were not necessary for the purposes of my investigation. Hedge portfolio refers to the position where a portfolio with a long position on companies is financed by a portfolio with a short position on companies, both positions being taken simultaneously. $\boldsymbol{N}$ stands for the number of firms fitted in the respective portfolio.

## 4.3. *Calendar-time regression*

As my investigation is focused on longer periods of performance evaluation of stock prices (monthly, over an 8-year period), the calendar-time approach is the most adequate. In this section I once more closely follow the methodology used by Setterberg (2011). I run three different regressions to perform an initial check on the statistical significance of the data used in this investigation. In the next section, I will discuss their results.

After all the necessary data was obtained, the following transformations were performed: first, I computed equally weighted monthly returns for each of the portfolio (Long, Short and PEAD) with different formation dates.

$$\boldsymbol{R_{p,f,t}} = \frac{\boldsymbol{1}}{\boldsymbol{N}}\sum_{\boldsymbol{i=1}}^{\boldsymbol{N}} \boldsymbol{R_{i,f,t}} \tag{7}$$

Where $\boldsymbol{R_{p,f,t}}$ represents an equally-weighted portfolio return of a type $\boldsymbol{p}$ with a formation date $\boldsymbol{f}$ at month $\boldsymbol{t}$ (where $\boldsymbol{t} \in \{1,2, \ldots,12\}$). $\boldsymbol{R_{i,f,t}}$ represents the return at month $\boldsymbol{t}$ of each individual company included in a respective portfolio with a formation date $\boldsymbol{f}$.

Considering the fact that I create portfolios on a quarterly basis, there are 4 overlapping months in each portfolio. With the previous computations, I obtain 12 monthly returns for each type of portfolio with a corresponding formation date.

This results in a conjunction of 3×12×4×8,5=1224 observations in total[7]. Each portfolio position accumulates 396 monthly observations.

I computed a Portfolio Excess Return as the difference between the monthly return of a specific portfolio and a risk-free rate for the respective month. This is the dependent variable used in each one of three calendar-time regressions which will be explained further ahead.

In the first test, I regressed values obtained from the difference presented above on the intercept, where portfolio excess return is slightly proxied to an abnormal return. This is done to check whether portfolios' returns are significantly over the risk-free rate, as represented in (8).

$$\boldsymbol{R_{p,t,f} - Rf_t = \alpha + \varepsilon} \tag{8}$$

Where $\boldsymbol{R_{p,t,f} - Rf_t}$ corresponds to monthly excess return of the portfolio with a formation date $\boldsymbol{f}$ at month $\boldsymbol{t}$ over the $\boldsymbol{Rf_t}$ – risk-free rate proxied by the 3M German Bond Bid Yield converted into a monthly rate. $\boldsymbol{\alpha}$ corresponds to a intercept. In the case of PEAD, a hedged position corresponds to the difference between Long and Short monthly returns, instead of excess return over risk-free rate. These are the same definitions I use for the two other regressions.

The second regression (9) serves as a way to measure statistical significance of the risk factor described in the CAPM Regression by William Sharpe (1964) and John Lintner (1965), regressing portfolio excess returns over the market excess returns.

$$\boldsymbol{R_{p,t,f} - Rf_t = \alpha^{capm} + \beta^{capm} \times RMRF_t + \varepsilon^{capm}} \tag{9}$$

Where the dependent variable is the same as used in (6). $\boldsymbol{RMRF_t}$ corresponds to a market excess return measured as the difference between $\boldsymbol{Rm_t}$ – a monthly return of the Eurozone Market and a risk-free rate – $\boldsymbol{Rf_t}$.

[7] Values used in this computation are 3 Positions (Long, Short and a Hedge) × 12 Months of Holding Periods × 4 Quarters per year × 8.5 Years. The odd number of years is justified by the fact that I form portfolios on a quarterly basis. Thus, using formation quarters from Q1 2008 through Q4 2016 and making the most common end of the shortest holding period under my analysis (3M) for the last sample quarter implies cutting the holding period after 3 months. This was done to guarantee that the period under analysis is always the same.

Finally, I use a three-factor regression described by Fama and French (1993). Besides the risk factor used in regression (7), two more factors are added here:

$$R_{p,t,f} - Rf_t = a^{3F} + b^{3F} \times RMRF_t + s^{3F} \times SMB_t + h^{3F} \times HML_t + \varepsilon^{3F} \quad (10)$$

The data available from Fama and French[8] does not provide does not provide the most adequate data for the Eurozone, only for Europe as a whole. Thus, the lack of data when running the last regression led me to create a database from scratch, based mainly on the methodology described by Fama and French (1993).

The sample is a conjunction of nearly all listed companies on the main Stock Exchanges of each country. It is also important to highlight that the countries included in my Eurozone sample are just the ones which adopted the euro before 2006. I also used this sample to compute a monthly value-weighted returns as a proxy for the Eurozone Market returns (Rm). The only difference to Rm is that, for 3-Factors data, I discard the companies which had a negative Book-to-Market ratio. The table below shows the average number of companies by industries present in the sample.

**Table 5.** Average number of companies by industry[9] per quarterly sample

| BM | CG | CS | F | HC | I | OG | TN | TC | U |
|---|---|---|---|---|---|---|---|---|---|
| 102 | 212 | 185 | 243 | 100 | 341 | 41 | 201 | 18 | 35 |

For each company I collect Market Values December 31st of t-1 of each year from 2007 to 2017, using Market Value (MV) datatype in Datastream. This is the metric/data preferred by Fama-French (1993) which is the product of the number of ordinary shares in issue by its corresponding share price. Another key data for Fama-French model is Book-to-Market Value (BTMV). I computed it by dividing one over Market-to-Book Value (MTBV), which I collect on December 31st of t-1 of each year from 2007 to 2017. The latter is defined as the market

[8] Link Kenneth R. French's website: http://mba.tuck.dartmouth.edu

[9] BM - Basic Materials, CG - Consumer Goods, CS - Consumer Services, F - Financials, HC - Health Care, I - Industrials, OG - Oil & Gas, T - Technology, T - Telecommunications, U - Utilities

value of the ordinary (common) equity divided by the balance sheet value of the ordinary (common) equity in the company (Worldscope item 03501).

The computations behind the SMB and HML are as follows: first, each year, in June, the median value was computed based on the market value for all companies, so as to divide the list of constituents into big and small groups. Secondly, inside each group I created 3 separate portfolios using 30% and 70% as breakpoints over the Book-to-Market Values among the companies. With these computations I constructed 6 portfolios: SL (Small MV and Low BTMV), SM, SH, BL, BM, and for BH (Big MV and High BTMV). Each of them provides monthly returns for up to 12 months ($June_{(t)}$ to $May_{(t+1)}$).

Now having 6 portfolios with 12 monthly returns each, I computed the two main metrics that are used in the last Regression:

- **SMB (Small minus Big)** – corresponds to the risk factor an investor faces regarding the firm's size, as it's assumed that companies with small capitalization usually generate higher returns, but at the cost of higher risk, compared to companies with larger capitalization. This is the difference between average monthly returns of three Small portfolios and three Big portfolios.

$$\boldsymbol{R_{SMB} = \frac{R_{SL} + R_{SM} + R_{SH}}{3} - \frac{R_{BL} + R_{BM} + R_{BH}}{3}} \quad (11)$$

- **HML (High minus Low)** – corresponds to a risk factor related to the excess return of value stocks (companies with high Book-to-Market Value – BTMV) over the growth stocks (with low BTMV). It is the difference between average monthly returns of two portfolios, one Small and one Big. Both the small and big portfolios are themselves constituted by a High BTMV and a Low BTMV portfolios.

$$\boldsymbol{R_{HML} = \frac{R_{SH} + R_{BH}}{2} - \frac{R_{SL} + R_{BL}}{2}} \quad (12)$$

# 5. Results

Above all, I would like to start my explanation of the results by showing, in general terms, abnormal returns generated by each formation quarter with a hedged position held over 12 months. I will then extend my analysis providing more details by testing this strategy on statistical significance against risk factors.

**Figure 1.** Buy-and-Hold Returns from the 12 months holding period of PEAD positions (Q1 2008 – Q4 2016)

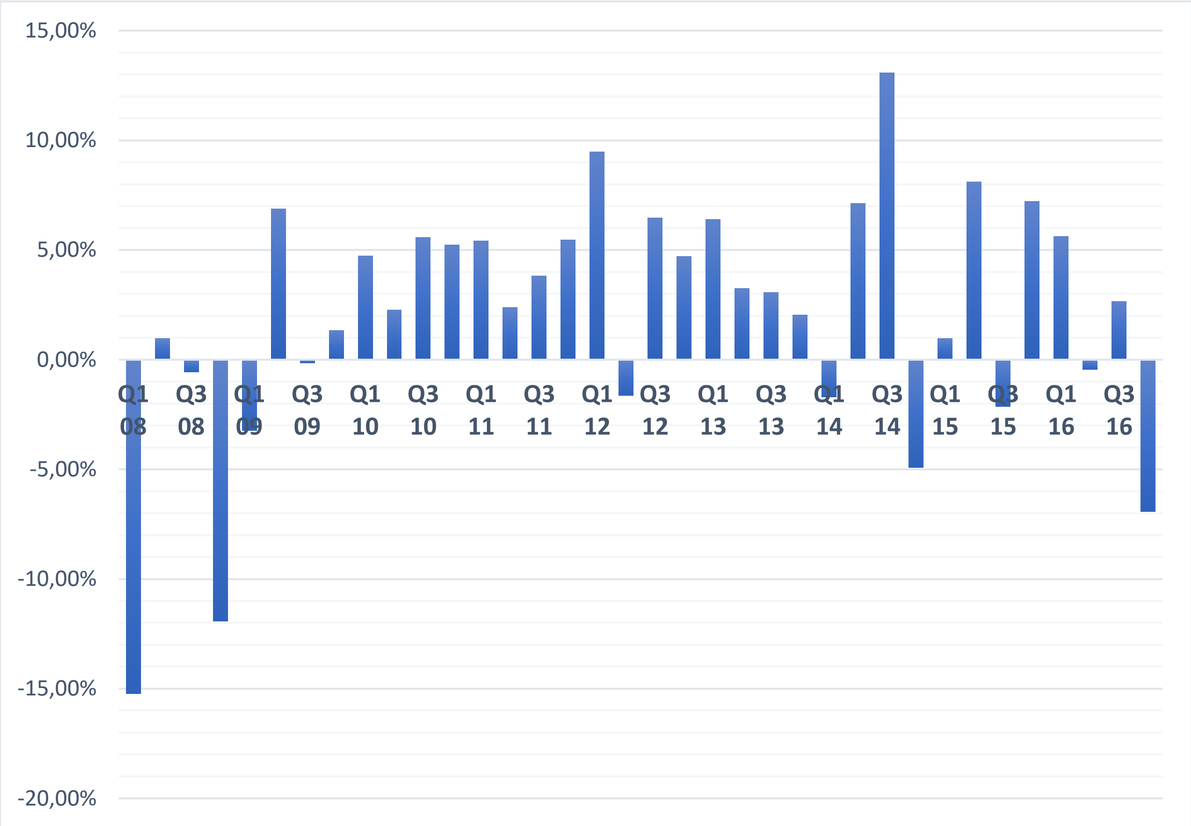


Figure 1. demonstrates that if a PEAD position is held for 12 months it generates positive returns in 29 cases and only 7 formation quarters resulted in negative returns. A simple average of Buy-and-Hold Returns results in about 4,96% annualized. From the graph we can also observe that Q1, Q4 2008 and Q1 2009 generated the most negative returns along the sample, which precisely coincides with the starting period of the global financial crisis.

**Table 6.** Average monthly rate of return (%) by decile and SUE (%) by decile

| Decile | Av. Monthly Rate | Av. SUE | Annualized Rate |
|---|---|---|---|
| **1 *short*** | 0,851*** | -2,865*** | 10,700 |
| **2** | 1,044*** | -0,882*** | 13,270 |
| **3** | 1,109*** | -0,409*** | 14,151 |
| **4** | 1,166*** | -0,189*** | 14,926 |
| **5** | 1,197*** | -0,063*** | 15,347 |
| **6** | 1,792** | 0,033*** | 23,756 |
| **7** | 1,144*** | 0,144*** | 14,630 |
| **8** | 1,148*** | 0,301*** | 14,675 |
| **9** | 1,252*** | 0,61*** | 16,106 |
| **10 *long*** | 1,394*** | 1,587*** | 18,066 |

i. Significance levels are ***, **, * at 1%, 5% and 10% respectively.
ii. Deciles are sorted in ascending order by SUE.

Table 6. shows that each decile provides a hypothetical positive return which is statistically significant. From this we can conclude that even the lowest decile generates positive returns. However, the difference between the highest (10$^{th}$) and the lowest (1$^{st}$) deciles remains positive, and the hedge position results in a monthly return rate of about 0.54% and 6.71% on an annual basis.

As the next step in trying to understand the impact of crisis, I would suggest reviewing the results by diving the sample into two periods, during and after the crisis.

**Table 7.** Results from calendar-time regressions over monthly returns up to 12 months of a holding period for three positions (Long, Short, PEAD). Full sample period between October 2008 – March 2017.

| | Crisis | | | Post-Crisis | | | Full Period | | |
|---|---|---|---|---|---|---|---|---|---|
| **Variable** | **Long** | **Short** | **PEAD** | **Long** | **Short** | **PEAD** | **Long** | **Short** | **PEAD** |
| *intercept* | 0,007 | 0,003 | 0,005* | 0,020*** | 0,014*** | 0,006*** | 0,014*** | 0,008*** | 0,005*** |
| *t-stat* | *(1.47)* | *(0.50)* | *(1.86)* | *(6.50)* | *(4.22)* | *(3.19)* | *(4.63)* | *(2.61)* | *(3.43)* |
| *p-value* | *(0.143)* | *(0.618)* | *(0.064)* | *(0.000)* | *(0.000)* | *(0.002)* | *(0.000)* | *(0.009)* | *(0.001)* |
| *N* | 204 | 204 | 204 | 204 | 204 | 204 | 408 | 408 | 408 |
| *Adj. R2* | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

i. Significance levels are ***, **, * at 1%, 5% and 10% respectively.
ii. Long represents a long position in the highest SUE decile, Short represents a short position in the lowest SUE decile and PEAD represent a hedge position where the returns from a short position are subtracted from a long position.

Looking at Table 7, we may conclude that the PEAD persists over eight years up until recently (March 2017). An average monthly return of 0.54% is statistically significant at the level of 1%, considering the full sample and a holding period of 12 months. We can also see from Table 7, that most of the return comes from the long position (1.36%/month) and that the hedge position is partially jeopardized by the short position since it provides positive returns (0.82%/month) which are significant at the same 1% level.

When comparing two periods, we may notice that the PEAD is only significant at a 10% level during the crisis period. In this case, the PEAD provides an average 0.47% return rate which, when annualized, amounts to 5.75%. I would also like to emphasize the fact that during the crisis both long and short positions are not statistically significant.

## 5.1. *PEAD vs. CAPM*

So far, I have tested the statistical significance of long, short and combined portfolios using univariate regressions, without taking into consideration any risk factors. Thus, I add a market risk factor into the regression as a possible explanation for those abnormal returns, following the CAPM.

**Table 8.** Results from calendar-time regressions with a market risk factor over monthly returns up to 12 months of a holding period for three positions (Long, Short, PEAD). Full sample period between October 2008 – March 2017.

| | **Crisis** | | | **Post-Crisis** | | | **Full Period** | | |
|---|---|---|---|---|---|---|---|---|---|
| **Variable** | **Long** | **Short** | **PEAD** | **Long** | **Short** | **PEAD** | **Long** | **Short** | **PEAD** |
| *intercept* | 0,005** | 0,000 | 0,005* | 0,009*** | 0,003 | 0,006*** | 0,007*** | 0,002 | 0,006*** |
| *t-stat* | *(2,06)* | *(-0,04)* | *(1,88)* | *(5,16)* | *(1,43)* | *(3,04)* | *(4,92)* | *(0,83)* | *(3,45)* |
| *p-value* | *(0,040)* | *(0,965)* | *(0,062)* | *(0,000)* | *(0,155)* | *(0,003)* | *(0,000)* | *(0,408)* | *(0,001)* |
| *RMRF* | 0,905*** | 0,923*** | -0,018 | 0,930*** | 0,927*** | 0,002 | 0,914*** | 0,926*** | -0,012 |
| *t-stat* | *(28,61)* | *(22,99)* | *(-0,51)* | *(21,36)* | *(17,88)* | *(0,05)* | *(37,18)* | *(30,45)* | *(-0,45)* |
| *p-value* | *(0,000)* | *(0,000)* | *(0,607)* | *(0,000)* | *(0,000)* | *(0,962)* | *(0,000)* | *(0,000)* | *(0,655)* |
| *N* | 204 | 204 | 204 | 204 | 204 | 204 | 408 | 408 | 408 |
| *Adj. R2* | 0,801 | 0,722 | -0,004 | 0,692 | 0,611 | -0,005 | 0,772 | 0,695 | -0,002 |

i. Significance levels are ***, **, * at 1%, 5% and 10% respectively.
ii. Long represents a long position in the highest SUE decile, Short represents a short position in the lowest SUE decile and PEAD represent a hedge position where the returns from a short position are subtracted from a long position.

Results from Table 8 indicate that market risk factor can't explain abnormal returns. The coefficient of the risk factor is not statistically significant neither when considering a full sample period nor when analyzed in two separate periods.

It is also noticeable that the returns of both long and short positions decreased in magnitude. However, this decrease was slightly disproportionate since the PEAD magnitude turned out marginally higher compared to the PEAD without a market risk factor. Also, comparing the PEAD among three time frames we see that the monthly return is concentrated around 0.5%. This provides annualized returns of 5.82% during the crisis, 7.65% post-crisis and 6.83% considering the whole sample. The last two are at 1% significance level, while the first one is significant at a 10% level.

## 5.2. *PEAD vs. Fama-French 3 Factors*

In addition to the market risk factor, the Fama-French Model suggests including size and value risk factors in order to test the significance of a portfolio. This way, it makes an adjustment for additional risk factors proxied by size and value.

In this subsection I provide results differently from the previous two tables. Since it is the most extensive model used in my investigation, I divide this analysis into three panels which differ by the time frames used. Each one contains results from 3 factor regressions over four holding periods. Later ones range from 12 months to a minimum of 3 months holding periods. Thus, I show performances for both long- and short-term investments.

According to results in Panel A, after adding 3 risk factors from the Fama-French Model to the simple regression, PEAD continues to be significant at 1% although partially explained by size and value risks when holding portfolio for 12 months. It provides 7.34% returns on an annual basis. However, the PEAD on the shortest period demonstrates much better results in terms of performance, and isn’t explained by any of the factors included.

Panel A. also confirms a “hedged position” of PEAD since there is a statistically significant high and positive correlation of over 98% with the market for both long and short positions considered separately. Nonetheless, this correlation is very close to zero and insignificant when a joint portfolio is considered. Once again, the major part of returns, with a holding period of 12 months, is from a Long position providing 7.30% vs. -0.03% from a Short position, both annualized. The holding period of 6 months can be characterized as having highest returns, with an 11.39% annualized return, but at the same time it is the riskiest one. Market risk factor is statistically significant at a 5% significance level, explaining such an abnormal return. However, the return for the holding period of

3 months is just slightly lower (10.86%), and is not explained by any factors, where the long position contributes 9.52%, and the short position produces -1.21% on an annual basis.

Panel A. also indicates that, over longer holding periods, size effects accentuate jointly with value risk, while, at the same time market risk decreases.

Panel B. demonstrates the results from the crisis period after the full sample is separated into two periods with a breakpoint at the end of the Eurozone crisis. Panel C. shows a post-crisis period. I did it with the purpose of better understanding the impact which the crisis had on the PEAD's performance. These two tables should be analyzed in conjunction.

One of the most noticeable differences between the two outputs is that results of PEAD from Panel C. are statistically significant and not explained by any of the risk factors, since none of them is statistically significant in the post-crisis period. The average monthly return during the period of crisis is 0.48% (5.90% annualized) versus 0.65% (8.08% annualized) after December 2012. This suggests that the effect of an unstable period of time implies an attenuation of the PEAD's magnitude. However, to clarify this affirmation I elaborate an additional analysis where the inception date is shifted to the latter months of 2009 (November), closer to the actual Eurozone Crisis.

**Table 9.** Results from calendar-time Regression 3 over monthly returns for 12, 9, 6 and 3 months of a holding period for three positions.

**Panel A**: October 2008 – March 2017

| | **Long** | | | | **Short** | | | | **PEAD** | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **12M** | **9 M** | **6 M** | **3 M** | **12M** | **9 M** | **6 M** | **3 M** | **12M** | **9 M** | **6 M** | **3 M** |
| **intercept** | 0,006*** | 0,007*** | 0,008*** | 0,008*** | 0,000 | -0,001 | -0,001 | -0,001 | 0,006*** | 0,008*** | 0,009*** | 0,009*** |
| ***t-stat*** | *(4,43)* | *(4,27)* | *(4,24)* | *(2,88)* | *(-0,02)* | *(-0,47)* | *(-0,54)* | *(-0,32)* | *(3,70)* | *(3,97)* | *(4,19)* | *(2,90)* |
| ***p-value*** | *(0,000)* | *(0,000)* | *(0,000)* | *(0,005)* | *(0,986)* | *(0,637)* | *(0,593)* | *(0,749)* | *(0,000)* | *(0,000)* | *(0,000)* | *(0,005)* |
| **RMRF** | 0,986*** | 0,989*** | 0,991*** | 1,028*** | 1,019*** | 1,069*** | 1,108*** | 1,089*** | -0,034 | -0,080* | -0,117** | -0,061 |
| ***t-stat*** | *(31,85)* | *(27,31)* | *(22,96)* | *(16,73)* | *(27,78)* | *(25,30)* | *(21,97)* | *(14,77)* | *(-0,90)* | *(-1,83)* | *(-2,33)* | *(-0,88)* |
| ***p-value*** | *(0,000)* | *(0,000)* | *(0,000)* | *(0,000)* | *(0,000)* | *(0,000)* | *(0,000)* | *(0,000)* | *(0,367)* | *(0,069)* | *(0,021)* | *(0,383)* |
| **SMB** | 0,354*** | 0,338*** | 0,378*** | 0,452*** | 0,514*** | 0,514*** | 0,485*** | 0,480*** | -0,160*** | -0,175*** | -0,107 | -0,029 |
| ***t-stat*** | *(7,42)* | *(6,06)* | *(5,68)* | *(4,77)* | *(9,09)* | *(7,89)* | *(6,24)* | *(4,23)* | *(-2,79)* | *(-2,59)* | *(-1,38)* | *(-0,27)* |
| ***p-value*** | *(0,000)* | *(0,000)* | *(0,000)* | *(0,000)* | *(0,000)* | *(0,000)* | *(0,000)* | *(0,000)* | *(0,006)* | *(0,010)* | *(0,168)* | *(0,788)* |
| **HML** | 0,170*** | 0,167*** | 0,179*** | 0,192*** | 0,279*** | 0,224*** | 0,196*** | 0,242*** | -0,109** | -0,057 | -0,017 | -0,051 |
| ***t-stat*** | *(4,66)* | *(3,92)* | *(3,53)* | *(2,64)* | *(6,45)* | *(4,51)* | *(3,30)* | *(2,78)* | *(-2,48)* | *(-1,10)* | *(-0,28)* | *(-0,62)* |
| ***p-value*** | *(0,000)* | *(0,000)* | *(0,001)* | *(0,010)* | *(0,000)* | *(0,000)* | *(0,001)* | *(0,006)* | *(0,014)* | *(0,272)* | *(0,776)* | *(0,538)* |
| **N** | 408 | 306 | 204 | 102 | 408 | 306 | 204 | 102 | 408 | 306 | 204 | 102 |
| **Adj. R2** | 0,805 | 0,803 | 0,810 | 0,815 | 0,760 | 0,770 | 0,791 | 0,780 | 0,024 | 0,018 | 0,019 | -0,008 |

i. Significance levels are ***, **, * at 1%, 5% and 10% respectively.

ii. Long represents a long position in the highest SUE decile, Short represents a short position in the lowest SUE decile and PEAD represent a hedge position where the returns from a short position are subtracted from a long position. Three regressions were run on each position. The first regression is a mere proxy to measure the significance of an excess return. The second regression is a CAPM model which measures the relationship of excess returns expected from the position in case with a systematic risk. The third regression adds two more risk factors (from the Fama-French model) to the market risk factor (CAPM), the size and the value risks.

**Panel B**: October 2008 – December 2012

| | | Long | | | | Short | | | | PEAD | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **12M** | **9 M** | **6 M** | **3 M** | **12M** | **9 M** | **6 M** | **3 M** | **12M** | **9 M** | **6 M** | **3 M** |
| **intercept** | | 0,005** | 0,005** | 0,007** | 0,007 | 0,000 | -0,001 | 0,000 | -0,001 | 0,005* | 0,006* | 0,007** | 0,007 |
| | ***t-stat*** | *(2,10)* | *(1,99)* | *(2,15)* | *(1,51)* | *(-0,12)* | *(-0,19)* | *(-0,11)* | *(-0,13)* | *(1,94)* | *(1,89)* | *(2,01)* | *(1,60)* |
| **RMRF** | | 0,940*** | 0,941*** | 0,954*** | 1,018*** | 0,983*** | 1,051*** | 1,086*** | 1,033*** | -0,043 | -0,110* | -0,133* | -0,015 |
| | ***t-stat*** | *(23,08)* | *(19,48)* | *(16,06)* | *(12,07)* | *(20,19)* | *(18,64)* | *(15,83)* | *(10,35)* | *(-0,91)* | *(-1,95)* | *(-1,97)* | *(-0,17)* |
| **SMB** | | 0,294*** | 0,269*** | 0,352*** | 0,478*** | 0,530*** | 0,548*** | 0,501*** | 0,471*** | -0,236*** | -0,280*** | -0,150 | 0,007 |
| | ***t-stat*** | *(4,15)* | *(3,20)* | *(3,41)* | *(3,26)* | *(6,26)* | *(5,60)* | *(4,21)* | *(2,72)* | *(-2,88)* | *(-2,85)* | *(-1,28)* | *(0,05)* |
| **HML** | | 0,176*** | 0,163*** | 0,209*** | 0,254** | 0,326*** | 0,275*** | 0,244*** | 0,299** | -0,150** | -0,113 | -0,034 | -0,044 |
| | ***t-stat*** | *(3,37)* | *(2,63)* | *(2,76)* | *(2,36)* | *(5,23)* | *(3,82)* | *(2,78)* | *(2,34)* | *(-2,49)* | *(-1,56)* | *(-0,40)* | *(-0,39)* |
| **N** | | 204 | 153 | 102 | 51 | 204 | 153 | 102 | 51 | 204 | 153 | 102 | 51 |
| **Adj. R2** | | 0,819 | 0,812 | 0,813 | 0,827 | 0,775 | 0,788 | 0,801 | 0,785 | 0,039 | 0,045 | 0,020 | -0,053 |

**Panel C**: January 2013 – March 2017

| | | Long | | | | Short | | | | PEAD | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **12M** | **9 M** | **6 M** | **3 M** | **12M** | **9 M** | **6 M** | **3 M** | **12M** | **9 M** | **6 M** | **3 M** |
| **intercept** | | 0,005*** | 0,006*** | 0,007*** | 0,008** | -0,001 | -0,002 | -0,003 | -0,004 | 0,007*** | 0,008*** | 0,011*** | 0,012*** |
| | ***t-stat*** | *(3,15)* | *(3,30)* | *(3,41)* | *(2,48)* | *(-0,67)* | *(-0,93)* | *(-1,28)* | *(-1,08)* | *(2,97)* | *(3,32)* | *(3,91)* | *(2,85)* |
| **RMRF** | | 1,149*** | 1,148*** | 1,138*** | 1,102*** | 1,156*** | 1,154*** | 1,223*** | 1,321*** | -0,007 | -0,005 | -0,085 | -0,220 |
| | ***t-stat*** | *(20,82)* | *(18,31)* | *(16,08)* | *(10,61)* | *(17,68)* | *(15,33)* | *(14,15)* | *(10,25)* | *(-0,09)* | *(-0,06)* | *(-0,94)* | *(-1,58)* |
| **SMB** | | 0,550*** | 0,527*** | 0,555*** | 0,580*** | 0,611*** | 0,578*** | 0,609*** | 0,706*** | -0,060 | -0,051 | -0,055 | -0,126 |
| | ***t-stat*** | *(7,00)* | *(5,89)* | *(5,50)* | *(3,92)* | *(6,55)* | *(5,39)* | *(4,95)* | *(3,84)* | *(-0,58)* | *(-0,43)* | *(-0,42)* | *(-0,64)* |
| **HML** | | 0,059 | 0,087 | 0,017 | -0,050 | 0,147* | 0,083 | 0,024 | 0,017 | -0,088 | 0,004 | -0,008 | -0,067 |
| | ***t-stat*** | *(0,87)* | *(1,13)* | *(0,19)* | *(-0,39)* | *(1,81)* | *(0,89)* | *(0,22)* | *(0,11)* | *(-0,97)* | *(0,04)* | *(-0,07)* | *(-0,39)* |
| **N** | | 204 | 153 | 102 | 51 | 204 | 153 | 102 | 51 | 204 | 153 | 102 | 51 |
| **Adj. R2** | | 0,772 | 0,783 | 0,798 | 0,764 | 0,716 | 0,711 | 0,752 | 0,757 | -0,003 | -0,018 | -0,017 | 0,033 |

## 5.3. *Additional Analysis*

Reviewing the literature regarding the Eurozone crisis I found two dates used as the inception of the crisis. First, the date at which Lehman Brothers defaulted marks an inception of a global financial crisis around September 2008. Secondly, according to Ahmad (*et al*., 2013) the financial contagion effects of various financial markets including GIPSI[10], which is highly interesting since those are the countries where the Eurozone crisis originated in October 2009, and which suffered the most from the crisis.

Table 8 shows results from regressions with 3 risk factors for four different holding periods using November of 2009 as the first month of the crisis period. The holding period of 12 months means that I include 12 individual monthly returns after the formation of the portfolio. The same logic applies to other holding periods.

Comparing the crisis period results from Table 8 to the results of PEAD column from Panel B we can observe that the magnitude expands significantly when we consider late 2009 as the inception of the crisis in Eurozone. From Panel B we can also see that after the crisis, regardless of the holding period, the PEAD is always statistically significant at the 1% level and none of the market risk factors, size or value can explain abnormal PEAD returns. Accentuation of the last two risk factors and attenuation of the market risk factor continues to occur in case of a longer holding period.

[10] GIPSI states for Greece, Ireland, Portugal, Spain and Italy.

**Table 10.** Results from calendar-time Regression 3 over monthly returns for 12, 9, 6 and 3 months holding period for the hedge position (PEAD) for three time frames. November 2009 – December 2012 – March 2017

| | **PEAD Crisis (2)** | | | | **PEAD Post-Crisis (2)** | | | | **PEAD Full Sample** | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **12M** | **9 M** | **6 M** | **3 M** | **12M** | **9 M** | **6 M** | **3 M** | **12M** | **9 M** | **6 M** | **3 M** |
| **intercept** | 0,009*** | 0,009*** | 0,011*** | 0,015*** | 0,007*** | 0,008*** | 0,011*** | 0,012*** | 0,008*** | 0,009*** | 0,011*** | 0,012*** |
| **t-stat** | *(3,77)* | *(3,22)* | *(3,36)* | *(3,89)* | *(2,97)* | *(3,32)* | *(3,91)* | *(2,85)* | *(5,13)* | *(5,06)* | *(5,56)* | *(4,54)* |
| ***p-value*** | *(0,000)* | *(0,002)* | *(0,001)* | *(0,000)* | *(0,003)* | *(0,001)* | *(0,000)* | *(0,007)* | *(0,000)* | *(0,000)* | *(0,000)* | *(0,000)* |
| **RMRF** | -0,057 | -0,090 | -0,167** | -0,074 | -0,007 | -0,005 | -0,085 | -0,220 | -0,047 | -0,056 | -0,133** | -0,143* |
| ***t-stat*** | *(-0,96)* | *(-1,25)* | *(-2,05)* | *(-0,78)* | *(-0,09)* | *(-0,06)* | *(-0,94)* | *(-1,58)* | *(-1,09)* | *(-1,10)* | *(-2,37)* | *(-1,87)* |
| ***p-value*** | *(0,336)* | *(0,215)* | *(0,044)* | *(0,439)* | *(0,926)* | *(0,950)* | *(0,349)* | *(0,121)* | *(0,278)* | *(0,272)* | *(0,019)* | *(0,065)* |
| **SMB** | -0,190** | -0,195** | -0,148 | 0,055 | -0,060 | -0,051 | -0,055 | -0,126 | -0,137** | -0,117* | -0,104 | -0,050 |
| ***t-stat*** | *(-2,39)* | *(-2,01)* | *(-1,35)* | *(0,43)* | *(-0,58)* | *(-0,43)* | *(-0,42)* | *(-0,64)* | *(-2,47)* | *(-1,79)* | *(-1,45)* | *(-0,51)* |
| ***p-value*** | *(0,018)* | *(0,047)* | *(0,180)* | *(0,668)* | *(0,563)* | *(0,667)* | *(0,672)* | *(0,528)* | *(0,014)* | *(0,075)* | *(0,149)* | *(0,613)* |
| **HML** | -0,105* | -0,077 | -0,032 | 0,032 | -0,088 | 0,004 | -0,008 | -0,067 | -0,081** | -0,039 | -0,019 | -0,012 |
| ***t-stat*** | *(-1,85)* | *(-1,11)* | *(-0,41)* | *(0,36)* | *(-0,97)* | *(0,04)* | *(-0,07)* | *(-0,39)* | *(-1,99)* | *(-0,80)* | *(-0,36)* | *(-0,17)* |
| ***p-value*** | *(0,067)* | *(0,269)* | *(0,680)* | *(0,722)* | *(0,335)* | *(0,968)* | *(0,947)* | *(0,700)* | *(0,047)* | *(0,422)* | *(0,722)* | *(0,868)* |
| **N** | 152 | 114 | 76 | 38 | 204 | 153 | 102 | 51 | 356 | 267 | 178 | 89 |
| **Adj. R2** | 0,028 | 0,018 | 0,035 | -0,047 | -0,003 | -0,018 | -0,017 | 0,033 | 0,018 | 0,003 | 0,023 | 0,022 |

i. Significance levels are ***, **, * at 1%, 5% and 10% respectively.
ii. In this table the results from the 3-Factors Fama-French model over different time frames and with different holding periods are demonstrated.
iii. 12M, 9M, 6M and 3M are the different holding periods of implementation for a PEAD investment strategy. For example, the holding period of 12 months means that data for a sample includes all individual monthly returns up to 12 months.

## 5.4. *Robustness Test*

As previously mentioned, I conducted robustness tests where I filtered out negative forecasts of Earnings Per Share, since analysts tend to be overoptimistic while making an estimate with a negative sign (Butler *et al*., 1999).

In Table 9 I demonstrate the results using a regression with 3 risk factors over PEAD. From it we can see that there is some attenuation in magnitude for each time frame. However, the period of the crisis starting in late 2009 still provides the highest returns which are statistically significant and not explicable by any of the risk factors used in the regression. Returns range from 6.39% (an annualized monthly return of 0.88%) with a 12 month holding period to 15.48% (annualized monthly return of 1.45%) with a 3 month holding period. This means that the shorter the period during which the portfolio is held, the higher the return on the positions. This, however, implies a more frequent rebalancing of the portfolio. Portfolios with such a high rebalancing frequency should be tested separately, since a more frequent rebalancing should imply higher transaction costs.

**Table 11.** Results from calendar-time Regression 3 over monthly returns for 12, 9, 6 and 3 months holding period for the hedge position (PEAD) for three time frames excluding Negative and Approximately Zero Estimated EPS. October 2008 / November 2009 – December 2012– March 2017

| | PEAD Crisis (2008) | | | | PEAD Crisis (2009) | | | | PEAD Post-Crisis | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **12M** | **9 M** | **6 M** | **3 M** | **12M** | **9 M** | **6 M** | **3 M** | **12M** | **9 M** | **6 M** | **3 M** |
| **intercept** | 0,002 | 0,002 | 0,004 | 0,005 | 0,005** | 0,007*** | 0,008*** | 0,012*** | 0,003* | 0,005** | 0,005** | 0,004 |
| ***t-stat*** | *(0,66)* | *(0,88)* | *(1,21)* | *(1,41)* | *(2,40)* | *(2,77)* | *(3,07)* | *(3,54)* | *(1,75)* | *(2,13)* | *(2,00)* | *(1,19)* |
| **RMRF** | -0,062 | -0,087* | -0,107* | -0,067 | 0,006 | 0,002 | -0,050 | -0,023 | 0,038 | 0,018 | -0,060 | -0,132 |
| ***t-stat*** | *(-1,47)* | *(-1,67)* | *(-1,74)* | *(-0,96)* | *(0,10)* | *(0,04)* | *(-0,73)* | *(-0,27)* | *(0,58)* | *(0,24)* | *(-0,68)* | *(-1,09)* |
| **SMB** | -0,188** | -0,229** | -0,125 | -0,056 | -0,066 | -0,113 | -0,081 | -0,012 | -0,089 | -0,080 | -0,161 | -0,268 |
| ***t-stat*** | *(-2,56)* | *(-2,54)* | *(-1,17)* | *(-0,47)* | *(-0,90)* | *(-1,31)* | *(-0,88)* | *(-0,10)* | *(-0,95)* | *(-0,75)* | *(-1,28)* | *(-1,56)* |
| **HML** | -0,114** | -0,108 | -0,057 | -0,151* | -0,070 | -0,079 | -0,065 | -0,120 | -0,006 | 0,053 | 0,033 | 0,077 |
| ***t-stat*** | *(-2,12)* | *(-1,63)* | *(-0,72)* | *(-1,70)* | *(-1,34)* | *(-1,30)* | *(-0,99)* | *(-1,45)* | *(-0,07)* | *(0,57)* | *(0,30)* | *(0,51)* |
| **N** | 204 | 153 | 102 | 51 | 152 | 114 | 76 | 38 | 204 | 153 | 102 | 51 |
| **Adj. R2** | 0,033 | 0,036 | 0,019 | 0,080 | -0,007 | -0,006 | -0,008 | 0,040 | 0,005 | -0,006 | -0,012 | -0,009 |

i. Significance levels are ***, **, * at 1%, 5% and 10% respectively.
ii. In this table the results from the 3-Factors Fama-French model over different time frames and with different holding periods are demonstrated.
iii. 12M, 9M, 6M and 3M are the different holding periods of implementation for a PEAD investment strategy. For example, the holding period of 12 months means that data for a sample includes all individual monthly returns up to 12 months.
iv. **Crisis (2008)** has as an inception date of October 2008, **Crisis (2009)** has as an inception date of November 2009. Both periods have December 2012 as an end date for the crisis. **Post-Crisis** refers to the period from January 2013 to March 2017.

# 6. Conclusion

The main goal of this dissertation was to investigate the impact that the global financial and debt crisis had on the performance of the PEAD strategy. The sample of this investigation consists of the companies listed on the principal indexes of each Eurozone country which had adopted the euro by 2006. This specific year is taken into consideration due to the full implementation of IFRS in Europe. However, in order to obtain a balanced analysis of the crisis and post-crisis period, I included data starting from 2008. This way, I was able to provide an updated and balanced analysis of two four year periods during and after the crisis.

Analyzing the results from econometrical regressions, I concluded that the PEAD strategy not only provides statistically significant returns, but also mitigates risk. This conclusion is based on the fact that Long and Short positions when taken separately are fully explained by risk factors. The same situation is not observable when considering the Hedge Portfolio.

It is also worth highlighting that the performance of the Hedged Strategy is higher and not explained by any of the factors used in the regressions when observing the post-crisis period (January 2013 – March 2017). However, the same does not happen when the period under analysis is out of the normal functioning of financial markets (*i.e.*, disturbances caused by financial stress inherent to the financial crisis [Hakkio and Keton, 2009]).

An additional analysis with a crisis inception date of November 2009, indicates an increase in magnitude, while a robustness test that consists in taking off negative EPS attenuates this magnitude. Nonetheless, the returns provided when this period is considered are still much higher than for other periods.

As for future research, I would suggest a more specified analysis focusing on each country separately. One limitation of this investigation is the use of mean EPS analysts' forecasts. As such, I would also suggest using median analysts' forecasts as the expected EPS. Further developments could also take into account other risk factors when testing the PEAD significance, since my investigation only provides test with market, size and value risks.

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